

MORPHOLOGICAL VARIABILITY OF MACROPHOMINA PHASEOLINA (TASSI) GOID. CHARCOAL ROT OF SORGHUM

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ABSTRACT

Twenty six isolates of *Macrophomina phaseolina*, causing charcoal rot of sorghum, obtained from different parts of Karnataka, Maharashtra and Andhra Pradesh, varied in their morphological characteristics. Colony diameter varied from 60.00 to 90.00 mm. The higher mean colony diameter was observed in Raichur, Gadag, Gulberga-2, Amaravati, Mulegoan, Solapur, Ahmednagar, Kopargoan, Shirdi, Nanded and Nizamabad isolates. On the basis of colony color, isolates were divided into 4 groups, i.e. grayish white (Dharwad, Ushmanabad, Parbhani); blackish gray (Raichur, Gadag, Gulberga-1, Gulberga-2, Bidar, Ramnagar, Zalki, Solapur, Pune, Ahmednagar, Kopargoan, Nanded, Jalna, Nizamabad, Akola); deep black (Bijapur, Athani, Amaravati, Mulegoan, Tulajapur, Rahuri); cottony white color (Patancheru, Shirdi). Blackish gray, deep black and cottony white color. Ramnagar isolates produced bigger size of sclerotia (94.0 μ m). Rahuri isolate produced the highest number of sclerotia (60.3 sclerotia/microscopic field 10X) and 110,135 and 180 sclerotia/9mm disc during 2nd, 4th and 6th days after inoculation, respectively.

KEYWORDS: *Macrophomina Phaseolina*, Isolates, Morphological & Variability

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INTRODUCTION

Sorghum is the fifth most important cereal crop of the world. It forms the staple diet of the poor people of the world, located especially, in India and Africa. In other countries, it is used as fodder, cattle feed and as an industrial raw material. In India, sorghum is predominantly grown in Andhra Pradesh, Maharashtra, Karnataka and some parts of Tamil Nadu, Rajasthan and Madhya Pradesh. Charcoal rot of sorghum is one of the economically important diseases of sorghum, all over the world. It occurs in areas, where drought conditions generally prevail at or after flowering. The disease is favored by high soil temperature ranging from 30 to 42 °c and low soil moistures. Sorghum is grown both during Southwest monsoon (*kharif*) and post monsoon (*rabi*) season. *Rabi* crop produces high quality grains as they mature during winter season under clear dry and rain free climate. However, low levels of productivity in *rabi* sorghum is due to drought and is aggravated by charcoal rot disease, which usually appears at grain maturity stage and cause severe lodging. Most improved varieties and hybrids are susceptible to the disease. The loss in grain weight due to charcoal rot in *rabi* cultivars varies from 18.53 to 63.22 per cent (Anon., 1999). A maximum 70.73 per cent grain weight loss has been reported in CSH13R, a high yielding commercial hybrid (Patil, 1980). The loss in grain yield is always more in *rabi* (40.83%) than in *kharif* (17.69 %) (Patil, 1980).

MATERIAL AND METHODS

Isolates of *M. phaseolina* were collected from different parts of Karnataka (Athani, Bidar, Bijapur, Dharwad, Gadag, Gulberga, Raichur); Maharashtra (Ahmednagar, Akola, Amaravati, Jalna, Kopargoan, Mulegoan, Nanded, Parbhani, Pune, Rahuri, Shirdi, Solapur, Tulajapur, Ushmanabad, Zalki) and Andhra Pradesh (Nizamabad, Patancheru, Ramnagar) constituting 26 infected sorghum samples in all. The morphological and cultural variability of the isolates was studied on the basis of various parameters such as colony color, texture, size, shape and number of sclerotia etc. For these studies, the isolates were grown and multiplied on potato dextrose agar (PDA) by inoculating half a centimeter disc of mycelial mat, taken from the periphery of seven days old culture of each of the 26 isolates. The plates were incubated at 27 (1°C). Colony diameter on PDA media was recorded for the second day, till the growth completely covered the plates. Observations on sclerotial morphology were taken at 7 days old cultures.

RESULTS AND DISCUSSIONS

Data with regard to colony characteristics are presented in Table 1. Based on colony diameter, the higher mean colony diameter was observed in Raichur, Gadag, Gulberga-2, Amaravati, Mulegoan, Solapur, Ahmednagar, Kopargoan, Shirdi, Nanded and Nizamabad isolates, and a significantly lower mean colony diameter was observed in Bijapur and Tulajapur isolates. Based on colony color, the cultures were assigned to four groups, i.e. grayish white (Dharwad, Ushmanabad, Parbhani); blackish gray (Raichur, Gadag, Gulberga-1, Gulberga-2, Bidar, Ramnagar, Zalki, Solapur, Pune, Ahmednagar, Kopargoan, Nanded, Jalna, Nizamabad, Akola); deep black (Bijapur, Athani, Amaravati, Mulegoan, Tulajapur, Rahuri); cottony white color (Patancheru, Shirdi). The isolates also could be assigned to two groups on the basis of texture; fluffy colony produced by Dharwad, Amaravati, Shirdi, Parbhani isolates and flat colony produced by Raichur, Zalki, Mulegoan, Solapur, Tulajapur, Ushmanabad, Pune, Ahmednagar, Kopargoan, Rahuri, Nanded, Jalna, Nizamabad and Akola isolates. These observations are in agreement with the findings of Shekhar *et al.*, (2006), who reported that Coimbatore isolate produced maximum mycelial growth; the minimum was in Delhi isolate. Bangalore and Arabhavi isolates produced grayish white color; Udaipur and Hyderabad isolate produced blackish gray, Ludhiana and Delhi isolates produced deep black center with creams periphery and Coimbatore isolate produced cotton white color. Similarly, Coimbatore isolate produced thick fluffy growth and Delhi and Ludhiana isolates produced less fluffy growth.

The majority of the isolates took 2-3 days for sclerotial formation, except Bijapur isolates, which took four days for sclerotial formation (Table-2). Such variations, in days required for sclerotial formation have been reported by Subramaniam (1994), who noticed that most of the isolates took 3-4 days for sclerotial formation, except oil palm (OP1, OP2 and OP4), groundnut (Gn), soybean (So) and maize (Ma) isolates, which took 5-6 days for sclerotial formation. The size of the sclerotia varied from 94.0 µm to 30.0 µm. It was observed that the Ramnagar isolate produced largest sclerotia of 94.0 µm; while the smallest size sclerotia of 30.0 µm was produced by Bijapur isolate. Similar observations were reported by Shekhar *et al.*, (2006), observed that the Hyderabad isolate produced largest sclerotia of 95.7 µm followed by Bangalore, Udaipur, Ludhiana, Delhi, Arabhavi, while the smallest sized sclerotia of 66.9 µm was noticed in Coimbatore isolate. Round shaped sclerotia were observed in Raichur, Bijapur, Gadag, Gulberga-1, Gulberga-2, Athani, Patancheru, Zalki, Mulegoan, Tulajapur, Pune, Ahmednagar, Kopargoan, Shirdi, Nanded, Jalns, Nizamabad and Akola isolates, while, the oblong shape of sclerotia were observed in Dharwad, Bidar, Ramnagar, Amaravati, Solapur, Ushmanabad, Rahuri and Parbhani isolates. Similarly Shekhar *et al.*, (2006), observed that the Udaipur, Bangalore, Coimbatore isolates had an oblong shape, whereas, the other one had round shape sclerotia. The number of sclerotia of 60.3 per microscopic field 10 X

was recorded in Rahuri isolate, while, the minimum number of sclerotia 40.0 per microscopic field was observed in Ushmanabad isolate. Similar observations were made by Shekhar *et al.*, (2006) that the maximum numbers of sclerotia /microscopic field (52.0) in Hyderabad isolate, while minimum number was observed in Coimbatore isolate (44/microscopic field).

CONCLUSIONS

The number of sclerotia /9mm disc varied from 110-50 during 2nd day, 135-72 during 4th and 180-100 during 6th days after inoculation (DAI) (Table-3). Among the isolates, Rahuri isolate had maximum number of sclerotia/9mm disc (110,135 and 180) during 2nd, 4th and 6th DAI, while, the minimum number was observed in Solapur (50) during 2nd DAI, Ushmanabad (72) during 4th DAI and Solapur, Ushmanabad, Ahmednagar (100) during 6th DAI. Similar observations were made by Shekhar *et al.*, (2006). They observed that Hyderabad isolate had maximum number of sclerotia/9 mm disc (180), while the minimum number was observed in Coimbatore isolate *i.e.*, 169/9 mm disc.

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APPENDICES

Table 1: Growth Characters of 26 Isolates of M. Phaseolina from Sorghum on PDA

Isolates	Mean Colony Diameter(Mm)	Colony Colour	Colony Appearance
Ri	90.00	Blackish gray	Flat colony
Bj	60.00	Dark black	Flat colony
Ga	90.00	Blackish gray	Flat colony
Gu-1	77.66	Blackish gray	Flat colony
Gu-2	90.00	Blackish gray	Flat colony
Dh	88.00	Grayish white	Fluffy colony
Bo	79.33	Blackish gray	Flat colony
At	88.00	Dark black	Flat colony
Rm	89.66	Blackish gray	Flat colony
Pa	85.00	Cottony white	Flat colony
Am	90.00	Dark black	Fluffy colony
Za	60.33	Blackish gray	Flat colony
Mu	90.00	Dark black	Flat colony
So	90.00	Blackish gray	Flat colony
Tu	60.00	Dark black	Flat colony
Us	88.00	Grayish white	Flat colony
Pu	88.33	Blackish gray	Flat colony
Ah	90.00	Blackish gray	Flat colony
Ko	90.00	Blackish gray	Flat colony
Ra	67.00	Dark black	Flat colony

Table 1: Contd.,			
Sh	90.00	Cottony white	Fluffy colony
Pr	80.33	Grayish white	Fluffy colony
Na	90.00	Blackish gray	Flat colony
Ja	75.00	Blackish gray	Flat colony
Nz	90.00	Blackish gray	Flat colony
Ak	88.33	Blackish gray	Flat colony
SE m _±	0.942		
CD at 1 %	3.55		

Table 2: Sclerotial Production by the Different Isolates of M. Phaseolina

Isolates	Days Taken for Sclerotial Body Formation	Sclerotial Diameter (□m)	Shape of Sclerotia	Number of Sclerotia/Microscopic Field
Ri	2	45.3	Round	42.3
Bj	4	30.0	Round	48.6
Ga	2	33.3	Round	45.0
Gu-1	2	39.3	Round	50.0
Gu-2	3	35.3	Round	49.3
Dh	2	36.0	Oblong	42.3
Bo	3	62.0	Oblong	47.3
At	2	60.6	Round	44.0
Rm	3	94.0	Oblong	49.6
Pa	2	70.6	Round	48.3
Am	2	89.3	Oblong	41.3
Za	2	88.6	Round	44.6
Mu	3	60.6	Round	42.6
So	2	93.3	Oblong	39.6
Tu	3	62.0	Round	45.0
Us	3	88.6	Oblong	40.0
Pu	2	84.6	Round	41.6
Ah	3	84.0	Round	41.0
Ko	3	81.3	Round	55.6
Ra	2	34.0	Oblong	60.3
Sh	2	36.0	Round	52.3
Pr	3	51.3	Oblong	52.6
Na	2	49.3	Round	51.6
Ja	3	58.0	Round	51.0
Nz	2	40.6	Round	46.6
Ak	3	88.0	Round	54.3
SE m _±		0.716		0.510
CD at 1 %		2.70		1.92

Table 3: Number of Sclerotia per 9 mm Disc Produced by Isolates of M.Phaseolina at Different Intervals

Isolates	Number of Sclerotia per 9mm Disc		
	2 DAI	4 DAI	6 DAI
Ri	60	79	105
Bj	74	93	128
Ga	71	89	118
Gu-1	78	110	140
Gu-2	70	95	130
Dh	61	76	103
Bo	70	92	123
At	63	82	113

Table 3: Contd.,			
Rm	75	99	135
Pa	72	94	125
Am	59	74	101
Za	65	80	110
Mu	61	80	110
So	50	79	100
Tu	69	85	115
Us	57	72	100
Pu	60	75	102
Ah	57	73	100
Ko	90	120	155
Ra	110	135	180
Sh	85	115	149
Pr	86	118	150
Na	83	115	145
Ja	80	110	143
Nz	70	90	120
Ak	91	125	153

